National Robotics Competition 2020

NRC – WRO Open Category Manual

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Introduction

Robotics is a wonderful platform for learning 21st century skills. Solving robotic challenges encourages innovation and develops creativity and problem-solving skills in students. Because robotics crosses multiple curricular subjects, students must learn and apply their knowledge of science, technology, engineering, math, and computer programming.

The most rewarding part of designing robots is that students have fun. They work together as a team, discovering their own solutions. Coaches guide them along the way, then step back to allow them their own victories and losses. Students thrive in this supportive and immersive environment, and learning occurs as naturally as breathing air.

At the end of the day, at the end of a fair competition, students can say they did their best, they learned, and they had fun.

Open Category NRC Rules

- NRC will follow the gameplay of WRO Challenge for the WeDo, elementary, junior and senior categories. The respective categories in NRC are WeDo, Primary, Secondary and Tertiary.
- The finals for the presentation will be on **17th & 18th November 2020**.
- The finals presentation time schedule will be informed by 30th October 2020

Competition format

- Finals through online video conferencing platform
- Teams will have to present to a panel of judges for the finals

Age Group Definition

1. WeDo: Participants 8 years old and below at year of competition
2. Elementary (Primary): Participants up to 12 years old in the year of competition.
3. Junior (Secondary): Participants 13 - 17 years old in the year of competition
4. Senior (Tertiary): Participants 16 – 19 years old in the year of competition

 NOTE:
- It is strictly enforced that students cannot be older than specified in the Age Group Definition.
- If all members of a team are younger than required, then the team must participate in the corresponding competition.
- Participants are not confined to school-going students. Anyone can participate in the corresponding age groups.

Team Definition

NRC is a team- based challenge. To participate in each category of competition, students must work in teams.

A team consists of one (1) coach and maximum 3 team members.

One (1) coach and one (1) team member is not considered to be a team and cannot participate.

Coaches

The minimum age of a coach in the NRC tournament (and assistant coaches) is age 20 at the time of registration for the NRC final.

Coaches may work with more than one team; however, each team needs to be assisted by a responsible adult. This person may be an assistant coach.

Coaches may offer students advice and guidance prior to the competition, however during the actual competition, **all work and preparation** must be performed by the student members of the team.

Material

1.1.   The display posters and materials of the teams must be within a 6m (W) x 2m (H) wall space in the backdrop of their video presentation. The teams may also use up to 2m of floorspace in front of the wall to display their robots. All elements on display must be visible during the video conference.
1.2.   Team members may be outside this space during a presentation, however, unless requested by judges, robots and other display elements must remain within the allotted area. All team members must be fully visible during the video conference.
1.3.   Teams can use a table to prop up their display. However, the size of the table should not exceed 120cm x 60cm and have to be within the allocated space.
1.4.   Teams can send in static photos of the display used as supporting documents to aid in the evaluation before their allocated timeslot. The files sent should be in jpg, png or pdf, and should not exceed 7 MB in total, with a maximum of 5 files within a zip folder. Zip folder should be named <school>_<team name>_SupportingDoc. These physical documents should also be visible during the video conference, such as the display poster.

Regulations about the robot

2.1.   There is no restriction on the balance between LEGO® elements and other materials.
2.2.   There is no restriction on the use of software.
2.3.   There is no restriction on the use of controllers.
2.4.   Robots may be preassembled, and software programs may be pre-made!
2.5.   For WeDo age group only: The controllers, motors and sensors used to assemble the robots must be from the LEGO Education WeDo 1.0/2.0 Core Sets. Any number and

combination of controllers, motors, and sensors is allowed. Any LEGO branded nonelectrical/non-digital elements can be used in the construction of the robot. The robot can be controlled by any compatible device or with a remote controller built from WeDo 1.0/2.0 elements. The teams can use any software. The teams can use any other materials for all elements that do not belong to the robot.

Competition

3.1. Open Category teams must go through this process:
- Final assembly and testing of the robot
- Preparation of the backdrop (including display of posters, etc.)
- Demonstration and presentation to the judges (including Q & A from judges) and demonstrations for the finals

3.2. Teams must decorate the backdrop with one or more posters with the minimum dimension of 120 cm × 90 cm. The poster(s) should introduce the robot project to the judges.

Presentation

4.1. The judging will be executed in four age groups: WeDo, Elementary, Junior, and Senior. Please refer to "*Age Group Definition*" above.

4.2. Teams will be allocated approximately 10 minutes for judgment – 5 mins to explain and demonstrate the robot, and how it relates to this year's theme, and the remaining time will be spent on Q&A with the judges.

4.3. Official language for all presentations is English. Interpreters are not allowed.

Awards

Teams will be judged based on the criteria shown in the next section. The following shows the awards for all categories.
International participants are not eligible for these cash prizes

Rank	Cash Prize Amount	Certificate
1st	$ 600.00	Certificate of Distinction
2nd	$ 600.00	Certificate of Distinction
3rd	$ 600.00	Certificate of Distinction
4th	$ 600.00	Certificate of Distinction
5th	$ 600.00	Certificate of Distinction
6th	$ 300.00	Certificate of Merit
7th	$ 300.00	Certificate of Merit
8th	$ 300.00	Certificate of Merit
9th	$ 300.00	Certificate of Merit
10th	$ 300.00	Certificate of Merit

Judging Criteria for Open Category

Category	Criteria	Points
1. Project (Total Points: 50)	**1. Creativity** - The project is original, worthwhile and shows creative thinking / innovative and imaginative design / interesting and divergent interpretation and implementation.	**10**
	2. Quality of Solution - The project is well-thought out and is a good solution to the problem. The solution supports the theme of the WRO season.	**15**
	3. Research & Report - It is clear that research was done. The report is a good summary of the project: the problems - solutions - process - findings - team - task.	**15**
	4. Entertainment Value - The project has a certain "WOW" factor - looks fun, captures the attention of passers-by - makes you want to see it again or learn more about it.	**10**
2. Programming (Total Points: 45)	**1. Automation** - The project uses appropriate inputs from sensors to run specific routines and clearly demonstrates automation in the completing of the tasks.	**15**
	2. Good Logic - The programming options used make sense, work reliably, are relevant in terms of their use, complexity and design.	**15**
	3. Complexity - The project uses multiple languages, sensors or controllers and incorporates more advanced / complex algorithms, structure and design.	**15**
3. Engineering Design (Total Points: 45)	**1. Technical Understanding** - Team members are able to produce clear, precise, and convincing explanations about each step of the mechanical and programming process.	**15**
	2. Engineering Concepts - The project shows evidence and good use of engineering concepts and team members are able to explain the concepts and need for use.	**10**
	3. Mechanical Efficiency - Parts and energy have been used efficiently - evidence of proper use of mechanical concepts / principles (gears/pulleys/levers/wheels & axles)	**10**
	4. Structural Stability - The project (robots and structures) are strong, sturdy and the demonstration can be run repeatedly - parts don't detach - little need for repairs.	**5**
	5. Aesthetics - The mechanical elements have aesthetic appeal, there is evidence that the team went out of their way to make the project look as professional as possible.	**5**
4. Presentation (Total Points 40)	**1. Successful Demonstration** - A demo of the capabilities was completed, there is a sense that it could reliably be repeated, and that preparation and practice have taken place.	**20**
	2. Communication & Reasoning Skills - The team were able to present their project idea in an interesting way - how it works - why they chose it - why it has relevance.	**10**
	3. Quick Thinking - The team are able to easily answer questions about their project. They were also able to deal with any problems that arose during the presentation.	**5**
	4. Posters and Decorations - The materials used to communicate the project to others are clear, concise, relevant, neatly prepared and engaging - Min 1 x (120 x 90).	**5**

5. Teamwork (Total Points: 20)	**1. Unified Learning Outcome** - There is evidence that team members have internalized knowledge and understanding of the subject matter pertaining to their project.	**10**
	2. Inclusiveness - The team are able to demonstrate that all members played an important role in the development, construction and presentation of their project.	**5**
	3. Team Spirit - The team display positive energy, good cohesiveness, value one another and are enthusiastic and excited about sharing their project with others.	**5**
		200

*Projects that are clearly not within the theme will receive a score of 0. Judges are requested to score each category from 0 to

10 with 10 being maximum. (A score of 9 to a criteria worth 25 points is equivalent to 22.5 points, etc.)

NRC 2020 THEME

CLIMATE SQUAD INTRODUCTION

You may have noticed that we are already experiencing the consequences of climate change. We are facing more forest fires, more extreme temperatures, longer heat waves, absent or overflowing precipitation and rising sea levels. Nature and the oceans normally act as climate regulators by absorbing carbon dioxide from the air. But the amount of greenhouse gases we emit from fossil fuels is so high that it exceeds nature's ability to absorb them.
We need your CLIMATE SQUAD to act!

Open Category teams will create robotic solutions to help avoid emitting greenhouse gases from fossil fuels or absorb greenhouse gases. We are looking for innovative solutions. Feel free to use different technologies and materials that you can find locally.

CLIMATE SQUAD MISSIONS

For the WRO Open Category in 2020, teams are asked to come up with innovative ideas for the following sub-topics. Teams may choose one of the two areas (1, 2) to work on, but they can also choose to work on a project focusses on both areas.

1. Manufacture locally to avoid transportation

The transport of goods and people is one of the main sources of greenhouse gas emissions. Nearly 10,000 aircraft are in flight at any given time, nearly 40,000 cargo ships are at sea and hundreds of millions of cars and trucks are on the roads, powered by fossil fuels.
Robotic solutions to manufacture locally what we need are being sought. This would avoid having the goods travel thousands of kilometers by boat, plane, car and truck using fossil fuels. These solutions shall use energy coming from renewable sources.

Similarly, solutions that allow physical work to be carried out remotely without having to travel long distances are also sought. This would reduce need for flying or commuting.

2. Restoring nature's ability to regulate the climate

Natural mechanisms capture greenhouse gases (mainly carbon dioxide) and sequester carbon while releasing oxygen. But humans have altered nature and these mechanisms, so we need your team, the Climate Squad, to restore them.

Robotic solutions for reforestation and wetland restoration are being sought, as well as solutions to increase the absorption capacity of greenhouse gases in natural environments.

You may find inspiration around this topic in the Sustainable Development Goal No. 13 "Take urgent action to combat climate change and its impacts", see more at: https://sustainabledevelopment.un.org/sdg13

SPECIAL REQUESTS BY AGE GROUP

WeDo

If you are in this category, you shall present a solution that will help you and your friends have a positive impact.

Elementary

If you are in this category, you will need to explain why your solution might be of interest to families or people around you.

Junior

If you are in this category, you will have to present the impact of your solution on current ways of doing things, lifestyle habits, etc. What will change? Who could benefit from it or be affected by it?

Senior

If you are in this category, you will have to demonstrate, with figures to support, the impact of your solution, if it were implemented, on the reduction of greenhouse gas emissions. Represent your data clearly and convincingly.